CLINICAL PROCEEDINGS

of the

CHILDREN'S HOSPITAL

WASHINGTON, D. C.

March 1951

VOLUME VII NUMBER 4

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CLINICAL PROCEEDINGS

OF THE CHILDRENS HOSPITAL

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CONGENITAL HYPERTROPHIC PYLORIC STENOSIS

A Review of 329 Cases

Special Report No. 202

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W. Warren Sager, M.D.

In the present series 329 unselected cases of congenital hypertrophic pyloric stenosis had pyloroplasties performed between the years 1919 and 1949 at the Children's Hospital, Washington, D. C. It is the purpose of this paper to present the existing data gleaned from the records.

Of this number 265 (80 per cent) were males against only 65 (20 per cent) females. This is entirely out of proportion to the incidence of male and female births, and is also entirely beyond explanation.

Previous reports comment on the low incidence in Negroes. There were 23 (7 per cent) cases of this race. Of these, 22 (95.6 per cent) were males.

There is a definite tendency for the anomaly to occur in first-born children. The incidence of first births numbered 171 (64.5 per cent). Second births were 18.4 per cent; third births, 12.4 per cent, and fourth, fifth, seventh, and eighth births were each roughly 1 per cent more or less.

Only 107 (33 per cent) of these patients were entirely fed by formula. Some consider this finding an indication of the general proportion of breast-fed children rather than of the susceptibility to this defect.

One patient had an older brother who had a pyloroplasty. Also two patients had older brothers to die of pyloric stenosis. One patient had two first cousins who experienced pyloroplasties for this condition. One patient's mother and another's father had pyloroplasties. From this it appears that there is also a tendency, though not strongly marked, for more than one case to occur in the same family.

Two of these patients, being twins, were operated upon each on the same day at the age of seven weeks and a large tumor was found in each case. Their older brother was six years old at the time and did not have pyloric stenosis.

Another patient had a twin who also experienced a pyloroplasty at about the same time at another hospital. Another was one of twins, yet his twin had no evidence of pyloric stenosis. Many believe there is undoubtedly a genetic basis. As yet the method of inheritance is certainly undetermined and an environmental factor may play a considerable role in its production.

Two of these patients had large umbilical hernias which required surgical repair at a later date. One had a cleft-palate. These were the only developmental defects noted in this series in conjunction with pyloric stenosis.

It was noted that the age of onset of symptoms was more likely to occur between the second and third weeks. Of a total of 321 cases, 87 (27.1 per cent) experienced vomiting at the age of two weeks and 81 (25.2 per cent) at the age of three weeks. Symptoms were present from birth in 36 (11.2 per cent) cases and during the first week of life 33 (10.3 per cent) noted vomiting. Forty-four (13.7 per cent) developed symptoms during the fourth week. The fifth and sixth weeks each revealed only 5.2 per cent. During the seventh, eighth, ninth, tenth, and twelfth weeks respectively, less than 1 per cent experienced the origin of symptoms.

In comparison with the age of onset of symptoms, of the 329 cases reported 80 (24 per cent) had a pyloroplasty performed during the fourth week of life. During each of the third, fifth, and sixth weeks of life, 15 per cent of the cases underwent operation for pyloric stenosis; while only 6 per cent were operated on during the second week of life. Eight per cent underwent surgery in the seventh and eighth weeks respectively. During each week from the ninth to the sixteenth less than 3 per cent experienced surgery. One infant each had a pyloroplasty performed in the twenty-third and twenty-fourth weeks of life. These were the oldest infants in this series to have operation for pyloric stenosis.

Of the several important symptoms of pyloric stenoses, and the one which usually attracts the physician's attention, vomiting is the most prominent. It was noted in every case of this series and in each case marked the onset of the condition. The onset may be sudden or gradual. Davison makes the point that the older the child the more likely is the onset to be abrupt. The vomiting which may be precipitated by the ingestion of only a few drops of food rarely begins as the projectile type, but in almost all of the cases promptly became so. In all the cases the vomiting was related to feeding. In every instance there was no bile present and the vomitus was strongly acid. There was always no initial anorexia and the child would nurse or take the bottle immediately after the vomiting ceased.

Most of the other symptoms of pyloric stenosis are a direct result of vomiting and, therefore, occur with considerable regularity. The bowels fail to move normally, not from constipation but because there is no intestinal residue. In this series there were scanty stools in 98 per cent of the cases, while actual diarrhea was noted in only 2 per cent of the babies. The stools as a rule were small and composed of mucus and bile.

Peristaltic waves across the epigastrium from left to right could be observed in 98 per cent of the cases. Only seven cases (2 per cent) did not show this feature. These waves appear shortly after the vomiting has begun and are best seen just after food has been taken and persist long after vomiting has ceased. When reaching the impermeable pylorus the waves appear to cease.

Such babies are usually strong and well at birth. In some series they are said to be stronger and weigh more at birth than the general average of 7½ pounds. In this series the average birth weight was 7½ pounds; the average weight at onset of symptoms was 7½ pounds; and the average weight at operation was also 7½ pounds. This rapid loss of weight is particularly striking because it occurs at a period when there should be rapid gains. The average weight following operation at the time of discharge from the hospital was 10½ pounds.

There has been considerable controversy about whether or not a tumor can be palpated. The hypertrophic pylorus can be commonly felt as an "almond-shaped" tumor just beneath the right lobe of the liver. In this series the tumor was palpated in 241 (74 per cent) cases. No tumor was felt in 71 (21.7 per cent) cases, and equivocal in 14 (4.3 per cent) of the cases reported. There are many techniques for examining the tumor which are most important and should be mastered by those treating this condition especially as some surgeons will not operate until they do palpate the tumor. The presence of a tumor is pathognomonic of pyloric stenosis.

As a rule, an elevation of temperature was not noted until dehydration, which tends to come on rapidly, appeared; or until infection ensued. In this series, 93 per cent of the babies were greatly dehydrated and 95 per cent of the babies were greatly dehydrated and 95 per cent were malnourished. Just as in any high intestinal obstruction, ketosis and alkylosis occur and glycosuria is occasionally noted. The dehydration leads to a scanty urine and a dry, wrinkled skin. The urine contains very little or no chloride. Alkylosis manifests itself clinically in most cases in the form of irregular shallow respirations and frequent periods of apnea. A few cases experienced tetany manifested not by carpopedal spasm but by muscular rigidity and rarely by a convulsion.

The chief diagnostic discussion at the present time centers about whether or not the x-ray studies should be made. Ladd states that if the five cardinal signs are present—projectile vomiting, scanty stools, loss of weight and dehydration, visible peristalsis, and a palpable tumor—x-ray is neither necessary nor desirable. Others not in favor of x-ray studies state that barium in the stomach at operation adds to the surgeon's difficulties and increases the possibility of opening into the duodenum. They also hold that lavage to remove the barium is an unnecessary tax on the child and may be misleading. On the other hand, it is said to be useful to define the degree of obstruction and the amount of retention. It is essential if the symptoms begin shortly after birth to establish the presence or absence of duodenal atresia. In the series of 329 cases, 55 (16 per cent) babies received barium x-ray studies prior to operation. In 47 (85 per cent) of these cases a large dilated stomach and from 90 to 100 per cent retention after 3½ hours were

reported. In each of these cases a large tumor was demonstrated at operation. In 6 cases or 11 per cent, the x-ray studies reported either a normal or slightly dilated stomach which emptied in a normal manner. In each of these cases a large pyloric tumor was demonstrated at operation.

In two cases (4 per cent), the stomach was seen to be dilated but at the end of 3½ hours there was 50 per cent retention of the barium in the stomach. Each case at operation had a large tumor.

Pre-operative preparation: Surgical treatment should be resorted to immediately in those cases which do not respond to medical measures promptly. There should be no delay except for adequate pre-operative preparation. This condition is not a surgical emergency and far more harm may come from operating hurriedly on an ill-prepared patient than by waiting a day or so until conditions are right. Though essential, this pre-operative therapy can be reduced to a few points. Its aim should be to restore the normal electrolyte and fluid balance, the amelioration of malnutrition, and the control of complicating infection. In each of the 329 cases here reported such aims were carried out. It is rather difficult to evaluate the findings as the cases date over a prolonged period of time during which such therapeutic measures as transfusions, fluids, antibiotics, and other drugs and procedures saw their birth. For completeness in this series of 329 cases, pre-operatively 186 received transfusions, 7 received plasma, and almost all received parenteral fluids.

As a rule most of the patients were given nothing by mouth; however, 150 cases received thick cereal feedings pre-operatively and of these in seven cases it was necessary to give thick cereal feedings post-operatively. In one instance thick cereal feedings were required post-operatively not having been used before operation.

It is interesting to note that in 227 cases atropine and phenobarbital were given before operation.

In each case the stomach was lavaged just before operation to facilitate exposure and packing. The operative field is small, but it is proportionately much larger than in adults hence the child was surrounded in each case by hot water bags and all portions of the body were kept covered except the immediate operative area.

Pre-operative medication is not necessary and none was used in this series. Experience indicated that premedication with morphine may actually be dangerous.

Drop ether is the anesthetic of choice. So little ether need be used that the patients are awake on leaving the operating room. In this series 306 (93 per cent) received open drop ether alone; 6 cases (1.8 per cent) were under local anesthetic using 1 per cent novocaine with open drop ether as a sup-

plement; in 9 cases (2.7 per cent) 1 per cent novocaine was the only anesthetic; in 3 cases (0.9 per cent) a whiskey sugar tit was used as a supplement to a local of 1 per cent novocaine; and in 5 cases (1.5 per cent) ethyl chloride was used as an aid to induction followed by open drop ether. All writers emphasize the fact that from the standpoint of anesthesia the operating team must wait on the patient and not the patient on the team.

A Fredet-Rammstedt pyloroplasty was performed on each of the 329 patients in this series. Since the technical details of this operation are now well known, only the general features of special importance will be discussed.

There were 45 different surgeons participating in this series. A right rectus incision was the one of choice being used in 80 per cent of the cases. In 14 per cent of the cases a transverse type of incision was used. A midline was performed in only 2 per cent and a right oblique was used in 4 per cent of the cases.

A tumor was found in each of the patients in this series. It was described as large in 93 per cent of the cases and small to moderate in size in 7 per cent of the patients.

The chief risk of the operative procedure is perforation of the duodenum at the point where the thick pyloric muscle ends. The success of the operation depends on all of the muscle fibers being separated especially on the gastric side. The accident of opening into the duodenum has been observed most often to occur not with knife but with the point of the hemostat while spreading the fibers. If the gut is perforated, small bubbles of air or bile will escape and if recognized can usually be easily closed with a small atraumatic type of stitch.

The duodenum was opened in 23 (7 per cent) cases of this series. Only one of these died and that occurred just eight hours post-operatively. None developed evidence of peritonitis.

In the 22 surviving cases in which the duodenum was perforated, it is interesting to note the post-operative care. Two cases were given water in two hours and formula in four hours—recovery uneventful; five cases were given nothing by mouth for eight hours, then water and breast or formula alternately—recovery uneventful; three were given nothing by mouth for twenty-four hours, then water and breast or formula alternately—recovery uneventful; one case had nothing by mouth for twenty-four hours, Levine tube stomach suction for twenty-four hours, then water and formula alternately—recovery uneventful; two cases had nothing by mouth for forty-eight hours, then water and formula alternately—recovery uneventful; two cases had nothing by mouth for forty-eight hours, Levine tube stomach suction for twenty-four hours, then water and formula alternately—recovery uneventful.

In only one case in which the duodenum was opened was a drain placed into the wound. It was removed in twenty-four hours with an uneventful recovery.

Evisceration at the time of operation is carefully avoided as is dragging on the celiac plexus as the tumor is elevated.

Only 2 per cent of the wounds were closed with through and through interrupted sutures, while 98 per cent were closed in layers.

Thirty-five of the 329 cases were closed using fine catgut for the peritoneum and interrupted fine cotton for the fascia and skin. All the remainder of the wounds were closed using fine catgut for the peritoneum and fascia with interrupted silk sutures for the skin except one case which was closed with fine catgut and wire stures. Skin clips were used in only one case.

The average length of operating time was twenty-seven minutes. The shortest length of operating time was seven minutes and the longest seventy minutes.

The post-operative care of the child presents a problem of a rather perverted gastro-intestinal physiology. The head should be lowered until complete recovery from the anesthetic as this prevents the aspiration of mucus. The body heat should be carefully maintained and the diet should be regulated to insure adequate sugar and chloride requirements.

Immediately following operation in this series, as soon as the patient had reacted water and formula were instigated in 61 per cent of the cases. The other 39 per cent of the patients had water and formula withheld for eight to twelve hours. The most important consideration is that the feedings should be small in quantity. Gastroenteritis may follow the unwise administration of large quantities of food before the gastro-intestinal tract has regained its normal tone.

All of the patients received intravenous or subcutaneous fluids post-operatively. Only 39 per cent (128 cases) were given blood transfusions after operation.

Atropine and phenobarbital were given in 20 of the cases post-operatively. Five cases received penicillin, 1 received streptomycin, and 2 received sulfadiazene post-operatively for either otitis media or other secondary infections.

Following operation only 3 per cent of the cases experienced absolutely no vomiting. The remainder as a rule vomited several times.

All writers emphasize the importance of getting the child out of the hospital as quickly as possible. Brevity of hospitalization after surgery is one of the chief arguments in favor of this type of therapy. In this series the average total days spent in the hospital was seventeen days. The shortest was one day and the longest was one hundred days.

Separation of the wound edges with evisceration occurred in 8 cases (2.4

per cent). Four of these cases also had infection of the wound before separation. Separation occurred on an average of the fifth post-operative day. There were no deaths from wound separation and evisceration.

Infection of the wound occurred in 12 (3.6 per cent) cases. Of these, only 1 died and that was due to acute peritonitis.

In two cases a secondary operation was necessary. The first of these had a pyloroplasty on a large tumor. His symptoms cleared after operation but returned so that seven weeks later a second operation revealed the duodenum to be stenosed at the ligament of Treitz by a thickened band. A gastro-enterostomy was performed with complete recovery.

The second case continued to experience projectile vomiting after a pyloroplasty. The wound eviscerated on the fourth post-operative day. Two months later the abdomen became distended and mass was palpated. A second operation revealed a large pyloric tumor with no evidence of the earlier pyloroplasty. Another Fredet-Rammstedt was performed and after a stormy post-operative course complicated by pneumonia, he recovered.

In this series there was a surgical mortality of 13 (3.9 per cent) deaths following the pyloroplasty. An autopsy was performed in each instance and the findings are as listed below:

1. Died suddenly on fourth post-operative day.
   Autopsy—a. Peritonitis.
   b. Gastro-enteritis (diarrhea).
2. Died suddenly on twelfth post-operative day.
   Autopsy—Meningitis (Staphylococcus albus and gram negative bacillus).
3. Died suddenly eight hours post-operatively.
   Autopsy—Pulmonary atelectasis.
4. Died on fourteenth post-operative day.
   Autopsy—a. Peritonitis.
   b. Atelectasis.
   c. Subdiaphragmatic abscess.
5. Died on eighth post-operative day.
   Autopsy—a. Bronchopneumonia.
   b. Peritonitis.
   c. Gastro-enteritis.
6. Died on first post-operative day.
   Autopsy—a. Pulmonary atelectasis.
   b. Coagulation defect (prothrombin deficiency as evidenced by bloody fluid in the peritoneal cavity, large bowel, and lack of clot formation in heart and large blood vessels).
   c. Patent foramen ovale and ductus arteriosus.

7. Died on second post-operative day.
   Autopsy—a. Bilateral pulmonary atelectasis.
   b. Patent ductus arteriosus.
8. Died on sixteenth post-operative day.
   Autopsy—a. Gastro-enteritis (diarrhea).
   b. Fibrocystic disease of pancreas.
   c. Pulmonary atelectasis.
   d. Hepatitis.
9. Died on fourteenth post-operative day.
   Autopsy—a. Gastro-enteritis (diarrhea).
10. Died on tenth post-operative day.
    Autopsy—a. Peritonitis.
    b. Pulmonary atelectasis.
    c. Pulmonary and pericardial effusion.
11. Died suddenly eight hours post-operatively.
    Autopsy—Pulmonary atelectasis.
12. Died suddenly on second post-operative day.
    Autopsy—Asphyxia due to aspiration of gastric contents.
13. Died suddenly at home on forty-sixth post-operative day.
    Autopsy—Bronchopneumonia.

The chief causes of death are pulmonary atelectasis, peritonitis, gastro-enteritis and bronchopneumonia. Other causes of death were meningitis, subdiaphragmatic abscess, developmental anomalies of the heart, coagulation defect of blood, fibrocystic disease of the pancreas, and asphyxia.

In each of the 329 cases of this series, examination of the laboratory findings prior to operation revealed an approximately normal hemogram and no abnormal urinary findings in any case.

It is interesting to note that 166 of the patients in this series were typed for blood groups as follows:

Type AB	5
Type A	68
Type B	20
Type O	73

Fifty-eight patients in this series had Rh determinations performed. Of these 48 (82 per cent) were Rh positive and 10 (17 per cent) were Rh negative.

Type	*No. Rh Positive*	*No. Rh Negative*
AB	1	0
A	24	2
B	4	1
O	19	7
Total	48	10

A follow-up was attempted in each of the 329 cases of this series. Due to the transient population of this area, contact was made with only 36 patients. A detailed history and follow-up of each of these revealed only one child to be underweight. The others were well developed talking and walking at the proper age, and all seemed to be doing excellent work in school, usually at the top of the class. All cases have made a normal sociological and psychological adjustment.

Follow-Up Chart

Age of Patient	*Number of Patients*
1 year	4
2 years	8
3 years	7
4 years	1
6 years	2
7 years	7
8 years	1
9 years	4
11 years	1
14 years	1

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GENERALIZED VACCINIAL ERUPTIONS

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Variola, or smallpox, is an acute contagious disease caused by a virus. It has an abrupt onset with constitutional symptoms followed by an eruption that passes through successive stages of macules, papules, vesicles, pustules, and crusts.[1] *Vaccinia*, or cowpox, is a disease primarily of cattle, which occur in man as "the development and decline of an eruption at the site of inoculation with virus of vaccinia and the concurrent reaction of the body."[2] Jenner in 1798 was the first to publicize the significant relationship between inoculation or "vaccination" with material from cowpox and lasting protection against smallpox. From that time until the present, smallpox has lost its role as a prevalent disease of childhood. In the United States there has been a decline from an average of 40,000 to 50,000 cases per year in the first decade of this century to an average of 400 to 500 cases per year in the recent decade.[3] The difference is undoubtedly due to development of better techniques and the wider use of vaccination as a routine measure. There is a virtual absence of smallpox in states where vaccination is compulsory.[4]

The adoption of vaccination as a universal procedure necessitates a full knowledge of its contraindications as well as of its value. Complications known to occur in the course of vaccination include: encephalitis myelitis, neuronitis, retinitis, orchitis, and purpura. Those involving the skin are classified according to his concept of their pathogenesis by Paschen:[5]

1. Those due to direct contact with vaccinia virus.
   a. Secondary vaccination near the original site.
   b. Secondary vaccination at distant sites in the absence of previous skin disease (auto-inoculation).
   c. *Secondary vaccination at distant sites in the presence of previously diseased skin.* (Eczema vaccinatum).
2. Those due to hematogenous spread of virus.
   a. Exanthems following or during the process of vaccinia.
   b. *True generalized vaccinia in a narrow sense with no previous skin disease.*
3. Eruptions coincidental with vaccinia.
4. Mixed inoculation or infection of the vaccination site, e.g., tetanus, syphilis.

Our concern in this report will be with the italicized groups above, those vaccinial lesions occurring in generalized scattered areas on the body of persons with or without previous skin disease who have had direct or in-

direct contact with vaccinia virus. These criteria include all cases defined either as generalized vaccinia or eczema vaccinatum.

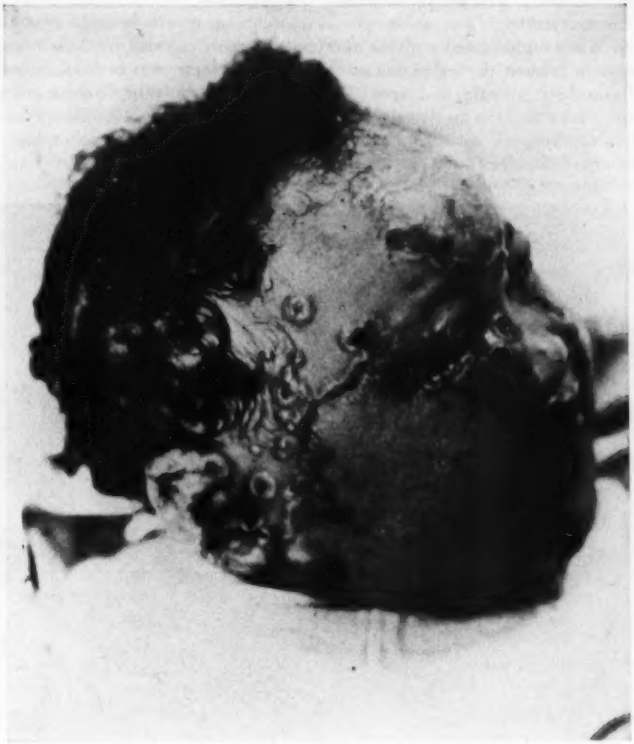

FIG. 1

CASE REPORTS

Two such cases have recently been admitted to The Children's Hospital:

Case No. 1.

M. M., a seven month old colored female, was admitted to the hospital on March 2, 1950 with complaints of eczema and fever for two days. The eczema had first appeared on the face at three months of age and had progressed to involve the legs in the month before admission. Dietotherapy had been attempted with little success. About two days before admission the patient developed fever and was noted to have an accentuation of the eczema and the presence of new papules.

One injection of "triple toxoid" had been given without untoward reaction one month previously. About eighteen days before the onset of the patient's fever, a

cousin, aged ten months, who lived in the same home, had been vaccinated successfully for smallpox.

Physical examination of the patient showed a moderately ill baby, well developed and well nourished. His cheeks, forehead, the outer surface of his legs, and his right arm were covered with a crusting, pustular, weeping, eczematous process (Figures 1 and 2). Many umbilicated papules and pustules were present in these areas. Two papules were present on the abdomen. In addition, there was noted: edema of the face, bilateral otitis media, and signs of pneumonia in the left upper chest posteriorly. Laboratory examination disclosed a hemoglobin of 9.8 grams; 3,400,000 erythrocytes; and 12,600 leukocytes with 62 neutrophiles, 36 lymphocytes, 1 eosinophile, and 1 monocyte per 100 cells. Blood culture and serological test for syphilis were negative.

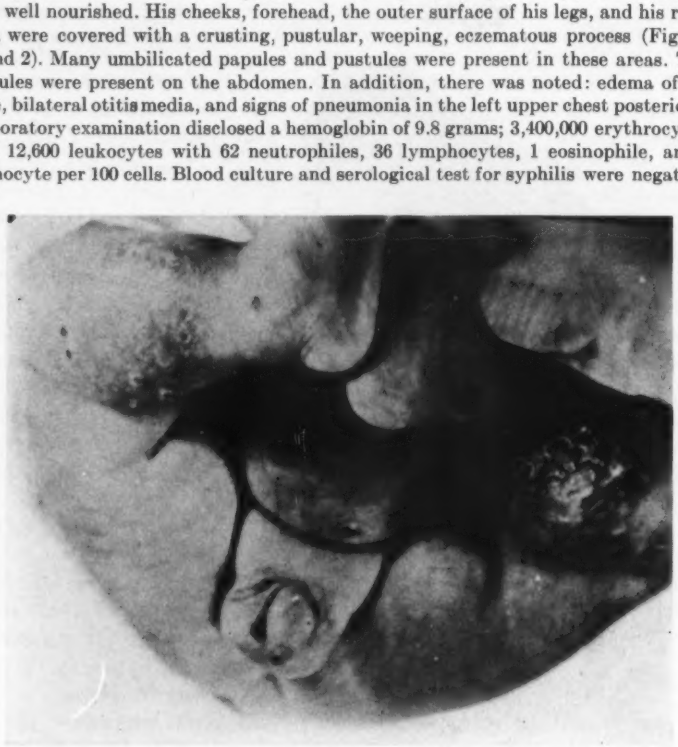

FIG. 2

The child was placed on Mullsoy formula and a low allergic diet; saline soaks were applied to the affected areas; and both penicillin and aureomycin in therapeutic dosages were given.

A spiking febrile course continued for seven days after which the fever slowly abated. Umbilicated lesions continued to appear, despite some drying of the eczema, until the fifth or sixth hospital day. Thereafter, there was gradual improvement so that the vaccinia lesions had disappeared and the eczema was clearer when the patient was discharged on March 23, 1950.

Case No. 2

C. M., a six year old colored male, was admitted to the hospital on September 18, 1950 with fever and a rash. Ten days prior to admission the child had been vaccinated

by multiple puncture over the left deltoid. Four days later he developed a skin eruption in the flexor surfaces of his elbows. Fever ensued and further lesions erupted on the face and on several areas of his chest, neck, and arms. The eruptions were first papular, then progressed to pustules and were markedly pruritic. On the day before admission the boy's eyelids and face became edematous and he began to vomit.

The past history included the presence of infantile eczema in the child from neonatal period to about two years of age. Routine triple toxoid inoculations had been without event. He had had measles but not varicella.

Physical examination showed a very uncomfortable, well developed youngster whose right eye was closed and exuded a purulent material. There was a good vaccinial "take" in the pustular stage on the left arm. On the face, neck, left ear, the flexor surfaces of the elbows, and on the left wrist and the chest were seen multiple

TABLE 1

Five Cases of Generalized Vaccinial Eruptions seen at Children's Hospital in past ten years

COLOR SEX	AGE	PREVIOUS SKIN DISEASE	VACCINATION		INCUBATION PERIOD	ANTIBIOTIC	DURATION OF LESIONS
			Patient	Contact			
					days		*days*
WF	12 mos.	Eczema	0	+	3–4	Penicillin	7
CF	17 mos.	Eczema	0	+	9	Penicillin Chloromycetin	12
CM	2 yrs.	Eczema	0	+	21	Furacin	4
CM	7 mos.	Eczema	0	+	18	Penicillin Aureomycin	20
CM	6 yrs.	History of Eczema as infant.	+	0	4	Aureomycin	10

pustular lesions 2 to 5 millimeters in diameter. In addition, there was excoriation of the nares, marked tonsillar hypertrophy and inflammation, cervical lymphadenopathy, and left axillary lymphadenopathy.

The laboratory examinations showed that the leukocytes numbered 4,000 with 48 neutrophiles, 50 lymphocytes, and 2 monocytes per 100 cells. Serology was negative.

Treatment included low allergic diet, elixir pyribenzamine, local saline soaks, and aureomycin in therapeutic dosage. Within forty-eight hours there was regression of all symptoms and skin lesions. The temperature reached normal on the third hospital day. When the patient was discharged on September 25, 1950 only a few skin lesions in a crusted stage remained.

We have reviewed the records of the hospital for the recent ten years and have been able to extract three additional cases of generalized vaccinal eruptions. The accompanying chart summarizes pertinent data of these cases plus the two herein recorded. The first three cases have been reported previously (Table I).

DISCUSSION

Definition

Various writers differ in their definitions of eczema vaccinatum and generalized vaccinia. Since the vaccinia virus is found in widespread areas of the body during vaccinial reactions,[8, 9] it is not logical to state with Paschen as a differential point that in generalized vaccinia the spread of virus is hematogenous and in ezema vaccinatum the spread is by direct contact. The difference between the two is one of arbitrary definition; to say, for example, as some authors do, that: a) eczema vaccinatum refers to the generalized vaccinial eruption when it occurs in a person with previous skin disease and/or one who has had only accidental contact with virus; b) generalized vaccinia refers to the process when it occurs in a person with intact skin and/or one who has himself been vaccinated. Pathologically both are the same. For clarity we shall consider them the same and, when necessary, shall point out any conditioning factors such as pre-existing dermatoses or type of contact with virus.

Some authors feel that Kaposi's Varicelliform Eruption is clinically indistinguishable from the generalized vaccinial eruptions.[7, 9, 10] Others feel that the term is merely a descriptive one and should be discarded.[3] Since the virus of herpes simplex has been isolated from several cases so diagnosed,[10–13] it is possible that it represents an individual entity. (c.f. differential diagnosis below).

Etiology, Pathogenesis

Vaccine virus has been recovered from the lesions of generalized vaccinia in humans[8, 9, 22] as well as from most of the viscera of animals in whom the condition has been produced experimentally.[8b] There is no doubt that it is the causative organism of such eruptions. Either hematogenous or lymphogenous dissemination or spread by direct or indirect contact from a site of vaccination is possible. A lack within the skin of antibody response to vaccine virus may be a key factor.[9] The dose and virulence of the strain of virus may be of importance in the pathogenesis.[2]

Transmission Infectiousness, Incubation Period

The virus is evidently readily transmissible from person to person as is shown by a high incidence of generalized vaccinia among non-vaccinated persons (c.f. below) and by the occurrence of local epidemics. Danziger reported an outbreak in five children among fifteen patients on a ward where a case of generalized vaccinia was hospitalized.[14] All those affected had skin disorders.

The incubation period varies from one to seven days in those persons who

have themselves just been vaccinated and from two to three weeks in those who acquire the virus by indirect contact.[18]

Incidence, Mortality

The incidence of generalized vaccinia has been variously estimated from one case among 10,000 vaccinations to one among 900,000 vaccinations.[3] Its occurrence in Great Britain was calculated at one case in 96,756 vaccinations with a mortality rate of 11.7 per cent of total cases or 1.2 per million vaccinations.[2]

The incidence during the threatened smallpox epidemic in New York City in 1947, when over 6,000,000 persons were vaccinated, was one case in 138,000 inoculations.[15] The mortality rate was 4 per cent of total cases or 0.3 per million vaccinations. McKahnn and Ross report a fatality rate of 33 per cent among thirty-nine cases diagnosed as eczema vaccinatum.[16]

There is no significant variation in incidence related to color or sex, although in the New York City experience, males and Negroes were apparently much more susceptible.[3, 15] It was felt that these differences could be explained as coinciding with the higher incidence of eczema in males and the greater chances of intimate contact among Negroes.

A high majority of cases occur in childhood or infancy, those times when vaccination is usually accomplished. Of the cases in New York City, 75 per cent were under five years of age, 33 per cent were under one year.[15] Lynch has cited nine cases of dermatological conditions of fetuses which he felt were generalized vaccinial reactions following the intra-gestational vaccination of the mother.[17] Although previously vaccinated persons are not immune to generalized vaccinia, the incidence among them is lower and reactions less severe.[2, 18]

Predisposing Factors

The greatest single factor predisposing to generalized vaccinia is previous skin disease. All of the cases seen at Children's Hospital, Washington, D. C. in the past ten years had eczema. Eighty-two per cent of the cases in the New York City series (38 of 45 cases) had a history of infantile eczema.[15] Equally striking is the fact that 74 per cent of those cases with previous dermatoses, had not themselves been vaccinated but gave a history of contact with a recently vaccinated person. Reported predisposing skin disturbances other than eczema are seborrhic dermatitis, pyodermas, burns, and allergic purpura.[19–22]

Clinical History and Findings.

The clinical picture of generalized vaccinia includes the following:

1. History of preceding skin disease in a majority of cases.

2. History of recent vaccination or contact with a recently vaccinated person. No history of contact with smallpox.
3. Fever, usually gradual in onset, sustained.
4. Toxicity.
5. Eruption of the successive stages of vaccinia on asymetrically scattered areas of the body, frequently on sites of distribution of previous eczema.
6. Pruritis.
7. Lymphadenopathy. Hepatosplenomegaly.
8. Varying degrees of local edema, weeping and superinfection of affected skin areas.

The duration and course of the illness depend upon the severity of infection. There are usually not any prodromata as in variola, nor a fall of fever with the onset of rash. The usual lesions seen are umbilicated pustules 6 to 10 millimeters in diameter. Mustard and Hendrick state concerning their series of fifteen cases:[3]

> There was a rapid spread and progression of lesions on the second day of illness. The temperature frequently reached 105.0 F. From the second to seventh days of the illness, successive crops of lesions erupted. The temperature of less severely affected patients usually subsided by the fifth or sixth day. In some . . . patients, the temperature persisted as high as 104.0 F. until the eighth or tenth day. . . . The lesions in the early stages were umbilicated pustules. This form persisted for six to twelve days when the lesions became crusted and larger than the original. This stage lasted for a variable period, then desquamated, leaving an atrophic pale pink macule.

Laboratory

Laboratory aids to the diagnosis are:

1. Actual virus isolation.[22]
2. Indirect evidence of the presence of vaccinia virus.
   a. Demonstration of antibody rise during convalescence e.g. by neutralization tests or complement fixation.[22]
   b. Paul's Test.[23] Scarified rabbit cornea is inoculated with material from lesions. If vaccinia or variola virus is present, panophthalmitis will follow and histological section of the cornea may show inclusion bodies typical of the cowpox-smallpox group, Guarnieri bodies.

Differential Diagnosis

With an adequate history, the diagnosis of generalized vaccinia should not be difficult. Since Kaposi's varicelliform eruption assumes so similar a

picture and is, as a descriptive term, at times used synonymously with generalized vaccinia, the accompanying table of differentiating points, modified from Riley and Calloway[13] may be helpful.

	Generalized Vaccinia	*Kaposi's*
Recent vaccination	+	−
Recent herpes simplex	−	+
Greatest age incidence	Children	Adult
Type of lesion	Papules-umbilicated pustules.	"Herpetic" groupings of vesicles
Rabbit cornea		
Herpetic inclusion bodies	−	+
Guarnieri bodies	+	−
Evidence of immune bodies		
Herpex simplex	−	+
Vaccinia virus	+	−

The following other conditions must be considered in the differential diagnosis: variola, impetigo, erythema multiforme bullosa, multiple vaccination by auto-inoculation, herpes zoster, pustular syphilis.[3]

Treatment

First mention in the treatment of general vaccinia must be given to *prevention:*

1. Vaccination is contra-indicated in a child with eczema or a history of eczema and certain other dermatoses as well as leprosy and the lymphomas. The latter two may be accentuated during the vaccinial reaction.[24]
2. Vaccination accomplished in the first few months of life may prevent complications in children destined later to develop skin diseases.
3. Any person to be vaccinated should be questioned thoroughly for eczematous disorders in himself or potential contacts.
4. No person recently vaccinated should be permitted contact with an eczematous person.
5. Cases of generalized vaccinia should be handled in strict isolation.

Active Treatment

This should include in principle:

1. Anti-allergic therapy, viz., dietary, enviromental, antihistaminic.
2. Antibiotic therapy, prevention of superinfection.
3. Symptomatic dermatological therapy, e.g., saline or potassium permanganate soaks.
4. General supportive therapy.

Neither our experience nor several recent reports [25] support aureomycin or chloromycetin as being conclusively of benefit in the treatment of generalized vaccinia other than to prevent superinfection. Evans has advocated the use of immune serum or whole blood from recently-vaccinated per-

sons.[26] Gordon states that the virus of vaccinia is susceptible to potassium permanganate and suggests its use as wet compresses in widespread vaccinial eruptions.[27]

SUMMARY

1. Two recent cases of generalized vaccinial eruptions and comparative data from three previous cases are reported. The subject is reviewed and the literature abstracted.

2. The difference between eczema vaccinatum and generalized vaccinia is arbitrary.

3. The greatest factor predisposing to generalized vaccinial eruptions is previous eczema.

4. A majority of reported cases occur among persons who have not themselves recently been vaccinated, but who have had contact with newly-vaccinated persons.

5. Principles for prevention and treatment are outlined.

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REPORT ON INGUINAL HERNIAS IN FEMALE CHILDREN

Special Report No. 203

Robert Pender, M.D.
John Lucas, M.D.
Gerald H. McAteer, M.D.

A five year study (1945–1950) of the operative female inguinal hernias at Children's Hospital has impressed upon us that the condition is relatively common, is serious if neglected, and repair carries slight morbidity. Before the data obtained from the study is reported, a brief discussion of the comparative embryology of the male and female would seem helpful.

At the end of the third fetal month in the male, the testicle, which has developed retro-peritoneally, begins its descent toward the scrotum. At this time, a finger-like projection of peritonuem, the processus vaginalis, outpockets into the rudimentary scrotum. As descent progresses and is completed by the ninth intrauterine month, the distal portion of the processus vaginalis attaches to the testicle and the proximal portion obliterates shortly after birth to form a cord-like structure. Failure of this obliterative process leaves a potential sac into which abdominal viscera may herniate.

During the early fetal life of the female, the round ligament is accompanied through the abdominal inguinal ring by a finger-like prolongation of peritoneum, the homologue of the processus vaginalis in the male. Ordi-

narily, this diverticulum, the Canal of Nuch, becomes obliterated by the end of the sixth intrauterine month. The persistence of the Canal of Nuch explains the existence of hernia in the inguinal region of females. As this type of hernial sac enlarges, it may drag into the sac part of the suspensory ligament of the ovary which, at its lateral extremity, is not far from the internal inguinal ring.

Our study is based on fifty-five female inguinal hernias which were operated upon during the same period, five years. Concomitantly, 1,050 males were operated upon during the same period. Thus, 5 per cent of the cases were females compared to 10 per cent reported by Ladd and Gross. The age incidence is composed of 3 neonatal cases, 22 cases in infancy, 15 cases between the ages of 2 and 5 years and 15 cases above the age of 4. Thus, at this hospital, the condition is most commonly found in the 2 year period of infancy.

There were 75 per cent Private cases and 25 per cent Staff cases, which corresponds to the usual Private-Staff ratio. Eighty per cent were in white girls and 20 per cent in colored. This would seem to indicate that the condition is more common in the white race. However, the colored population is about 25 per cent of the total in this area.

Nine per cent of the operations were done because of incarceration; 80 per cent were entirely asymptomatic except for the presence of an inguinal mass.

It is of interest to note the various contents of the hernial sac. Of prime interest is the finding of female internal genitalia in 20 per cent of all cases. Only 5 per cent contained bowel, all of which were incarcerated but viable. Five per cent had hydroceles and one case contained omentum in the sac. The latter occurred in a girl of five years, which seems logical since the omentum is not well-developed in infancy.

In nearly all cases, a Ferguson technique was employed to repair the defect. This consists of a ligation and excision of the sac and approximation of the conjoined tendon to Poupart's ligament. In three of the cases (5 per cent) internal genitalia was sacrificed. An oophorectomy and salpingo-oophorectomy were done because of gangrene and a salpingo-oophorectomy because of operative interference of blood supply. Two surgeons included a remark in their operative record that a low ligation of the sac was carried out because of adherent internal genitalia. This is of significance because, in the female, the inguinal canal does not contain vas deferens or gonadal blood supply and consequently may be obliterated surgically with impunity. A low ligation of the sac combined with a tight Ferguson procedure results in adequate repair. In view of the fact that dissection of the internal genitalia, which is adherent to the sac, may result in impaired blood supply to the parts, it would seem that low ligation would be preferred.

The mortality in this study was non-existent and the morbidity consisted of three cases of non-specific diarrhea—two of which did not increase hospital stay.

It is interesting to note that the hospital stay has steadily decreased in the last five years. In the period 1945–1946, the average stay was 9.5 days, 1947–1949 was 6.6 days and 1945–1950, 4.9 days. These figures would seem to coincide with the present day concensus of early ambulation following herniorrhaphy.

SUMMARY OF OUR STUDY

1. Five per cent of inguinal hernias occur in females.
2. They are usually asymptomatic and right-sided.
3. In 20 per cent of the cases, internal genitalia was contained within the sac.
   In 6 per cent of all cases, internal genitalia was sacrificed.
4. In instances of genital adherence to the sac, high ligation of the sac would seem to be dangerous and unnecessary.
5. The mortality has been zero, and the morbidity, low.
6. The length of hospital stay has steadily decreased.
7. Female hernias are more common than the literature would indicate.

PROLAPSE OF THE ANUS IN INFANCY AND CHILDHOOD

"A Simple Method of Treatment"

Special Report No. 204

Philip A. Caulfield, M.D.

Prolapse of the anus is seen very frequently during infancy and in early childhood. In the vast majority of instances it is not associated with any other condition, such as abnormalities of the anus, rectum or genitourinary tract, but usually occurs as the result of chronic constipation in children who are otherwise normal. In this way it differs from prolapse as seen in the adult, in whom the condition is always serious and often associated with other abnormalities. In the adult, procedentia of all the coats of the rectum frequently occurs. This is rarely the case in the child in whom the prolapse involves only the mucous membrane.

In most children, strapping of the buttocks tightly together with adhesive after each bowel movement, along with treating and overcoming of the constipation, will result in a cure of the condition in a short time. However, in some cases the condition will not respond to this simple method of

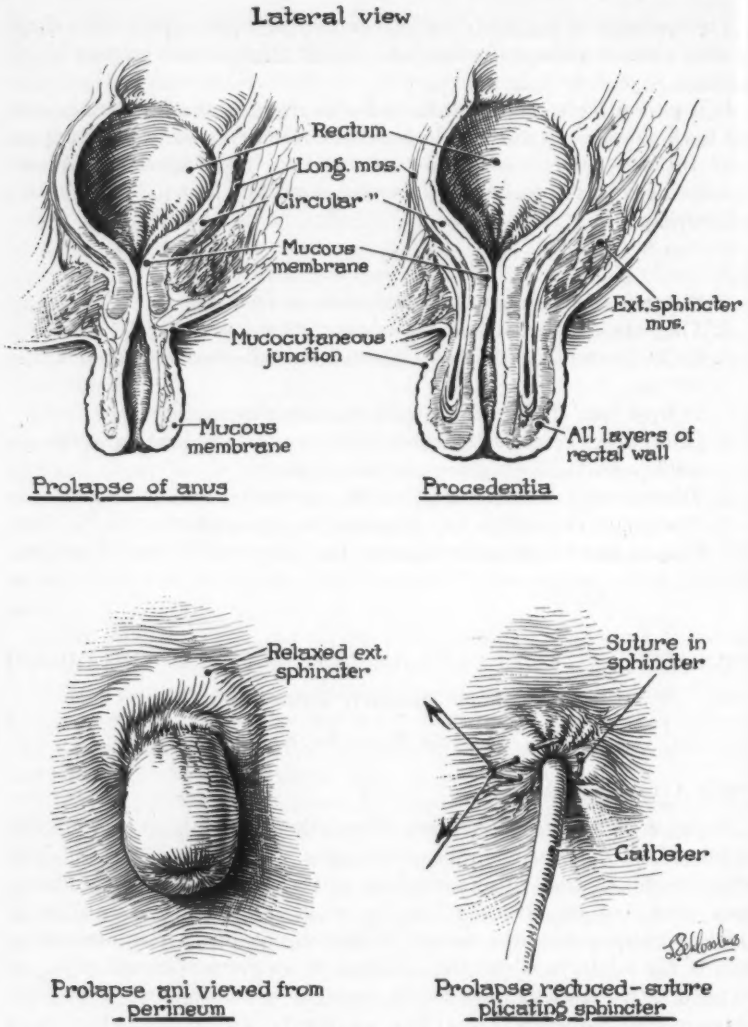

FIG. 1. Prolapse of the rectum

therapy. Because of the dilatation and complete lack of tone of the external sphincter, the mucous membrane will persistently protrude through the anus and soon becomes swollen, edematous and will bleed freely when touched. In this type of case, after reducing the prolapse, a simple purse string of #1

chromic catgut is placed at the mucous cutaneous junction of the anus, the needle being inserted deep enough to pick up the fibers of the external sphincter, and tied about a #20 French Catheter. No preliminary incision is made in the skin or mucous membrane. The purpose of this suture is to plicate the dilated sphincter and allow it to regain its tone. The catheter is inserted well into the rectum and is used as a rectal tube. It is allowed to remain in place for a period of 7 to 14 days. During this time the child is placed on a liquid diet and mild cathartics, such as castoria or mineral oil, are administered to keep the feces liquid. Ordinarily the tube does not have to be removed as it will be extruded spontaneously as soon as the catgut becomes weak enough to break. The buttocks may or may not be strapped with this method of therapy.

We have been using both these procedures, with equal success, for overcoming prolapse of the anus in children for almost ten years, and have not yet had a failure.

MONTHLY STATISTICAL DEATH CONFERENCE

Special Report No. 205

E. Clarence Rice, M.D.

Examination of the hospital statistics shows a marked decline in the number of deaths at Children's Hospital during the past three years. This corresponds with the increased availability and number of antibiotics which have been used during this period, which is reflected in the reduced number of deaths due to infection, which number but 47 or 36.1 per cent of the total. As mentioned in a previous issue of this publication, this brings into focus three groups of patients, viz., those with congenital anomalies, tumors, and leukemia. There is reason to believe that deaths from the first two categories will be reduced further as the diagnosis is made more accurately and as the surgeon devises improved methods of treating them.

During 1950 there were 130 deaths among the 8,624 patients admitted to the hospital for treatment. The diagnoses are classified as follows:

Infections			47
Bacterial			39
A. Non-tuberculous		34	
Meningeal	5		
Pulmonary	23		
Peritoneal	5		
Intestinal	1		
B. Tuberculous		5	
Virus and Rickettsial			6
Rheumatic fever			2

Congenital or developmental anomalies		3
Heart	14	
Other	16	
Tumors		8
Brain	4	
Neuroblastoma	2	
Lymphosarcoma	2	
Diseases of the Blood		9
Leukemia	7	
Other	2	
Neonatal		9
Prematurity or immaturity	5	
Hemorrhage	4	
Poisoning		2
Deaths during anesthesia		2
Disease of the reticulo-endothelial system (Niemann-Pick's disease)		1
Unclassified		3
Kidney Disease		3

The following table represents the number of deaths at Children's Hospital by year from 1936–1950 plus the number and percentage of autopsies for each period.

Year	*Deaths*	*Autopsies*	*Corrected* Percentage*
1936	303	157	51.1
1937	278	111	62.3
1938	213	145	68.0
1939	188	135	68.5
1940	201	148	73.5
1941	250	184	73.6
1942	270	172	63.7
1943	279	216	77.6
1944	266	204	76.7
1945	256	208	80.6
1946	222	177	79.7
1947	195	156	80.0
1948	127	109	85.8
1949	142	126	88.7
1950	130	114	87.6

* Corrected for coroner's cases.

Summary of Deaths, Dec. 1950

Name	*Age*	*Sex*	*Autopsy*	*Clinical Diagnosis*	*Pathological Diagnosis*
50-13909	1 day	WM	Yes	1. Prematurity 2. Intracranial hemorrhage	1. Atresia of the ileum with perforation 2. Acute peritonitis 3. Primary atelectasis, bilateral 4. Prematurity.
50-14025	6 weeks	WM	Yes	1. Atelectasis of left upper lobe 2. Exfoliative dermatitis	1. Exfoliative dermatitis 2. Pulmonary congestion and edema

Name	*Age*	*Sex*	*Autopsy*	*Clinical Diagnosis*	*Pathological Diagnosis*
50-140366	6 weeks	WM	Yes	1. Exfoliative dermatitis	1. Exfoliative dermatitis 2. Pulmonary congestion and edema 3. Cerebral congestion 4. Adrenal medullary congestion.
50-19037	6 weeks	WM	Yes	1. Exfoliative dermatitis	1. Bronchopneumonia, early 2. Exfoliative dermatitis.
50-13360	3 weeks	WM	Yes	1. Lobar pneumonia 2. Prematurity 3. Interventricular septal defect	1. Lobar pneumonia 2. Interventricular septal defect 3. Prematurity.
50-12590		CF	Yes	1. Adrenal insufficiency 2. Marasmus 3. Bronchopneumonia	1. Lobar pneumonia.
50-4378	13 months	WM	Yes	1. Hydrocephalus 2. Bronchopneumonia	1. Hydrocephalus 2. Chronic meningitis and encephalitis —bacterial 3. Pulmonary congestion and edema 4. Status post ventriculomastoidostomy.
	4 months	CM	Yes	1. Probable tetrology of Fallot with pulmonary atresia 2. Dextroposition of the stomach	1. Anomaly of the pulmonary venous return—all pulmonary veins enter the right auricle 2. Anomaly of the systemic venous return: A. Persistent left superior vena cava entering the left auricle B. Hepatic veins entering the right auricle C. Left inferior vena cava entering the left auricle 3. Absence of the coronary sinus 4. Common atrio-ventricular canal 5. Pulmonary atresia 6. Patent ductus arteriosus 7. Interauricular septal defect 8. Dextraposition of the stomach, duodenum, and pancreas 9. Absence of the spleen 10. Congestion of the viscera.
48 4395	3½ years	WF	Yes	1. Microcephaly 2. Cerebral agenesis 3. Acidosis and dehydration 4. Subcutaneous emphysema	1. Cerebral agenesis 2. Lobar pneumonia 3. Pulmonary mediastinal and subcutaneous emphysema 4. Fatty metamorphosis of the liver.
45 287	6 years	CM	Yes	1. Leukosarcoma 2. Lobar pneumonia	1. Leukosarcoma 2. Subdural, pulmonary, and peripelvic renal hemorrhage.
	10 years	M Chinese	Yes	1. Lymphosarcoma	1. Lymphosarcoma, primary in stomach or retroperitoneal lymph nodes.
	2 years	CM	No	1. Lipoid nephrosis	
	3 months	CM	No	Dead on arrival.	

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